"The Potential for Competition in the Market for Local Telephone Services" (with David N. Townsend and Paul S. Keller)
Presented at the Organization for Economic Cooperation and Development Workshop on Telecommunication Infrastructure Competition, December 6-7, 1993.

"Market Failure in Open Telecommunications Networks: Defining the new natural monopoly," *Utilities Policy*, Vol 4, No. 1, January 1994.

"The Enduring Local Bottleneck: Monopoly Power and the Local Exchange Carriers," (with Susan M. Gately, et al) a report prepared by ETI and Hatfield Associates, Inc. for AT&T, MCI and CompTel, February 1994.

"Commercially Feasible Resale of Local Telecommunications Services: An Essential Step in the Transition to Effective Local Competition," (Susan M. Gately, et al) a report prepared by ETI for AT&T, July 1995.

"Efficient Public Investment in Telecommunications Infrastructure" *Land Economics*, Vol 71, No.3, August 1995.

"Market Failure in Open Telecommunications Networks: Defining the new natural monopoly," in *Networks, Infrastructure, and the New Task for Regulation*, by Werner Sichel and Donal L. Alexander, eds., University of Michigan Press, 1996.

Dr. Selwyn has been an invited speaker at numerous seminars and conferences on telecommunications regulation and policy, including meetings and workshops sponsored by the National Telecommunications and Information Administration, the National Association of Regulatory Utility Commissioners, the U.S. General Services Administration, the Institute of Public Utilities at Michigan State University, the National Regulatory Research Institute at Ohio State University, the Harvard University Program on Information Resources Policy, the Columbia University Institute for Tele-Information, the International Communications Association, the Tele-Communications Association, the Western Conference of Public Service Commissioners, at the New England, Mid-America, Southern and Western regional PUC/PSC conferences, as well as at numerous conferences and workshops sponsored by individual regulatory agencies.

Statement of Qualifications

PATRICIA D. KRAVTIN

Patricia D. Kravtin is Vice President and Senior Economist at ETI. Ms. Kravtin did graduate study in the Ph.D. program in Economics at the Massachusetts Institute of Technology, where she was a National Science Foundation Fellow. Her fields of study have included Industrial Organization, Government Regulation of Industry, and Urban and Regional Economics. While at M.I.T., Ms. Kravtin performed research for the Sloan School of Management and the Joint Center for Urban Studies of M.I.T. and Harvard. Her own empirical work has centered on multiproduct industries and has included econometric estimation of multiproduct cost functions and measurement of product-specific economies of scale and economies of joint production.

While in Washington, D.C., Ms. Kravtin gained valuable insight into the regulatory process performing research and policy analysis at the United States Department of Commerce, the Securities and Exchange Commission, and the Private Radio Bureau of the Federal Communications Commission.

Since joining ETI in 1982, Ms. Kravtin has been actively involved in telecommunications regulatory proceedings in state jurisdictions throughout the country and has frequently testified as an expert witness before regulatory commissions. Ms. Kravtin has testified before the Rhode Island Public Utilities Commission, the Maine Public Utilities Commission, the Florida Public Service Commission, the New York Public Service Commission, the Louisiana Public Service Commission, the Minnesota Public Utilities Commission, the Mississippi Public Service Commission, the Arizona Corporation Commission, the Kentucky Public Service Commission, the Delaware Public Service Commission, the Georgia Public Service Commission, the Tennessee Public Service Commission, the New Hampshire Public Utility Commission, the New Jersey Board of Regulatory Commissioners, the Arkansas Public Service Commission, the Kansas Corporation Commission, and the California Public Utilities Commission. Ms. Kravtin has also testified as an expert witness in anti-trust litigation before the United States District Court for the Eastern District of Tennessee at Greeneville.

Ms. Kravtin's assignments have involved the analysis of both rate design and revenue requirements issues. She has performed analyses of various cost methodologies used by telephone companies to determine costs and set rates, and econometric demand models used to develop estimates of repression and stimulation of demand as a result of price changes. She has conducted numerous analyses of the costs and benefits of local measured service.

Ms. Kravtin has also been involved in the analysis of issues relating to telephone company modernization expenditures and plant utilization. Ms. Kravtin has presented testimony on the subject of infrastructure/plant modernization before the Ohio General Assembly senate select Committee on telecommunications Infrastructure and Technology and the New Jersey Senate Transportation and Public Utility Committee.

More recently, Ms. Kravtin has gained extensive expertise in the area of video and multi-media information service markets. Ms. Kravtin has submitted numerous filings before the FCC concerning the economics of video dialtone investment and/or VDT tariffs proposed by New Jersey Bell, Pacific Bell, Ameritech, Southern New England Telephone, US West, GTE, Bell Atlantic, BellSouth, NYNEX, Puerto Rico Telephone Company and Carolina Telephone in over 25 Section 214 Application proceedings.

Ms. Kravtin has authored and co-authored numerous papers and reports pertaining to these issues. These include the following:

"The Economic Viability of Stentor's 'Beacon Initiative,' Exploring the extent of its financial dependency upon revenues from services in the Utility Segment," prepared for Unitel, submitted as evidence before the Canadian Radio-television and Telecommunications Commission, March 1995.

"A Public Good/Private Good Framework for Identifying Pots Objectives for the Public Switched Network" prepared for the National Regulatory Research Institute, October 1991;

"The U S Telecommunications Infrastructure and Economic Development," presented at the 18th Annual Telecommunications Policy Research Conference, Airlie, Virginia, October 1990;

"An Analysis of Outside Plant Provisioning and Utilization Practices of US West Communications in the State of Washington," prepared for the Washington Utilities and Transportation Commission, March 1990; and

"Telecommunications Modernization: Who Pays?," prepared for the National Regulatory Research Institute, September 1988.

Ms. Kravtin has also been actively involved in the analysis of issues relating specifically to industry structure, BOC market power and MFJ restrictions, regulatory reform, price caps regulation, access charges, and local and long-distance competition in the telecommunications industry at both the state and federal level. Ms. Kravtin has served as an expert witness in antitrust cases involving BOC monopolization. She has co-authored numerous papers and reports pertaining to these issues. These include the following:

"Reply to X-Factor Proposals for the FCC Long-Term LEC Price Cap Plan," prepared for the Ad Hoc Telecommunications User Committee, submitted in FCC CC Docket 94-1, March 1, 1996.

"Establishing the X-Factor for the FCC Long-Terms LEC Price Cap Plan," prepared for the Ad Hoc Telecommunications User Committee, submitted in FCC CC Docket 94-1, December, 1995.

"Fostering a Competitive Local Exchange Market in New Jersey: Blueprint for Development of a Fair Playing Field," prepared for the New Jersey Cable Television Association, January 1995.

"The Enduring Local Bottleneck: Monopoly Power and the Local Exchange Carriers," February 1994.

"A Note on Facilitating Local Exchange Competition," prepared for E.P.G., November 1991;

"Testing for Effective Competition in the Local Exchange," prepared for the E.P.G., October 1991;

"Report on the Status of Telecommunications Regulation, Legislation, and modernization in the states of Arkansas, Kansas, Missouri, Nebraska, Oklahoma and Texas," prepared for the Mid-America Cable-TV Association, December 13, 1990;

"Sustainability of Competition in Light of New Technologies," presented at the Twentieth Annual Williamsburg Conference of the Institute of Public Utilities, Williamsburg, Virginia, December 1988;

"Industry Structure and Competition in Telecommunications Markets: An Empirical Analysis," presented at the Seventh International Conference of the International Telecommunications Society at MIT, July 1988;

"Market Structure and Competition in the Michigan Telecommunications Industry," prepared for the Michigan Divestiture Research Fund Board, April 1988;

"Impact of Interstate Switched Access Charges on Information Service Providers - Analysis of Initial Comments," submitted in FCC CC Docket No. 87-215, October 26, 1987;

"An Economic Analysis of the Impact of Interstate Switched Access Charge Treatment on Information Service Providers," submitted in FCC CC Docket No. 87-215, September 24, 1987;

"Regulation and Technological Change: Assessment of the Nature and Extent of Competition From A Natural Industry Structure Perspective and Implications for Regulatory Policy Options," prepared for the State of New York in collaboration with the City of New York, February 1987;

"Long-Run Regulation of AT&T: A Key Element of a Competitive Telecommunications Policy," *Telematics*, August 1984;

"BOC Market Power and MFJ Restrictions: A Critical Analysis of the 'Competitive Market' Assumption," submitted to the Department of Justice, July 1986; and

"Economic and Policy Considerations Supporting Continued Regulation of AT&T," submitted in FCC CC Docket No. 83-1147, June 1984.

Ms. Kravtin attended George Washington University on an Honor Scholarship where she received a B.A. with Distinction in Economics. She was elected to Phi Beta Kappa and Omicron Delta Epsilon in recognition of high scholastic achievement in the field of Economics. Ms. Kravtin is a member of the American Economic Association.

ATTACHMENT C

ANALYSIS OF INCUMBENT LEC EMBEDDED INVESTMENT:

An Empirical Perspective on the "Gap" between Historic Costs and Forward-looking TSLRIC

Implementation of the Local Competition Provisions in the Telecommunications Act of 1996

CC Docket No. 96-98

Lee L. Selwyn
Patricia D. Kravtin

May 30, 1996

ECONOMICS AND TECHNOLOGY, INC.

ONE WASHINGTON MALL • BOSTON, MASSACHUSETTS 02108

Preface | ANALYSIS OF INCUMBENT LEC EMBEDDED INVESTMENT

In its *Notice of Proposed Rulemaking* (NPRM) adopted April 19, 1996 in CC Docket No. 96-98, the FCC's proceeding on implementation of the local competition provisions in the *Telecommunications Act of 1996* (the Act), the Commission sought comment, *inter alia*, on the empirical magnitude of the differences between historical costs incurred by incumbent LECs (ILECs) and the forward-looking long-run incremental costs (LRIC) of the services and facilities they will be providing pursuant to Section 251 of the Act.[1] The matter of such a differential was raised by the Commission in the context of rates that ILECs would set for interconnection, collocation, and unbundled network elements.[2] In comments submitted to the Commission, a number of ILECs (and/or their experts) assert that there is a significant "gap" between historical embedded "revenue requirement" costs and the forward-looking Total Service Long Run Incremental Cost (TSLRIC) of the services and facilities that the ILECs will be providing pursuant to Section 251, and that the failure to recover historic costs will have deleterious effects on the ILECs.

Economics and Technology, Inc. (ETI) was asked by AT&T to undertake an empirical analysis of the embedded investment of major ILECs to examine critically the notion being advanced by the ILECs that they carry on their books a large base of old, obsolete plant, acquired at a high cost relative to current prices. Furthermore, the ILECs claim that it is this old, obsolete plant that is responsible for creating a divergence between their embedded costs and TSLRIC. This report summarizes the results of ETI's analysis of ILEC embedded investment and the conclusions to be drawn therefrom. This project was conducted under the overall direction of Dr. Lee L. Selwyn and Patricia D. Kravtin, President and Vice President—Senior Economist, respectively, at ETI. Research and analytical support for this project was provided by Sonia N. Jorge, Michael J. DeWinter, Paul S. Keller, and Irena V. Tunkel, of ETI.

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1. NPRM, para. 144.

2. *Id.*

The time frame of the Commission's proceeding has necessarily limited the scope of the analysis we could reasonably perform in response to issues and questions as complex as those raised in the NPRM and in the Comments of the parties concerning the nature of ILEC investments and the "gap" between historical embedded costs and TSLRIC. Accordingly, we have concentrated our attention, at least initially, on the ILECs owned by the seven Regional Bell Holding Companies. Where data was available, we expanded the analysis to include larger independent telephone companies, such as Southern New England Telephone Company (SNET). In addition, as a result of recent work in several proceedings before the California Public Utilities Commission, we have benefitted from the availability of certain additional data and information regarding Pacific Bell's investment, plant replacement and depreciation practices, and have incorporated this knowledge, which we believe to be representative of ILECs in general, into these results. Although ETI's empirical analysis was necessarily constrained by the limited availability of ILEC data, we believe that the results we have obtained are representative across Tier 1 ILECs.

Economics and Technology, Inc.
Boston, Massachusetts

May 30, 1996

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ANALYSIS OF INCUMBENT LEC EMBEDDED INVESTMENT

Tables

1 INTRODUCTION AND SUMMARY

Purpose of this Study

In the FCC's *Notice of Proposed Rulemaking* (NPRM) in CC Docket No. 96-98 regarding the *Implementation of the Local Competition Provisions in the Telecommunications Act of 1996*, adopted April 19, 1996, the Commission seeks comment, *inter alia*, on the empirical magnitude of the differences between the historical costs incurred by incumbent local exchange carriers (ILECs) (or historical revenue streams) and the forward-looking long-run incremental cost (LRIC)[1] of the services and facilities they will be providing pursuant to Section 251. The Commission further asks to what extent incumbent local exchange carriers can "reasonably claim an entitlement to recover a portion of such cost differences" in the rates set for interconnection, collocation, and unbundled network elements.[2]

In comments submitted to the Commission, the ILECs (and/or their experts) describe (but do not quantify) differences between historical embedded "revenue requirement" costs and the forward-looking Total Service Long Run Incremental Cost (TSLRIC) of the services and facilities that the ILECs will be providing pursuant to Section 251, and assert that the

1. The Commission uses the term Long Run Incremental Cost (LRIC) to refer generically to all types of forward-looking incremental costing methods. NPRM, para. 123. However, the Commission recognizes that some parties refer specifically to a "total service long-run incremental cost" approach. *Id.*, paras. 124-126. In this Report, we will hereinafter use the term TSLRIC, as the preferable type of long-run costing process that should be relied upon in the setting of interconnection and unbundled network element rates.

2. NPRM, para. 144.

failure to recover historic costs will have deleterious effects on the ILECs.[3] USTA presents the affidavit of Prof. Jerry A. Hausman, who argues that the recovery of ILEC historical embedded costs is required on the basis of "[p]roductive efficiency," i.e., to incent ILECs to continue to make efficient investments in their networks.[4] According to Prof. Hausman, TSLRIC does not permit the recovery of fixed and common costs, including "historical costs due to past network investments" in an "economically efficient manner."[5]

This Study responds to the points raised by the ILECS by examining both empirical and anecdotal evidence concerning the "gap" between historical embedded "revenue requirement" costs and bottoms-up aggregate TSLRIC results. In particular, this Study examines critically the notion, implicit in the arguments raised by the ILECs, that carried on their books is a relatively large base of old, obsolete, and relatively costly plant, responsible for creating a divergence from TSLRIC results that the ILECs are entitled to recover.

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3. For example, SBC Communications (SBC) argues that "incremental costs fail to account for certain ILEC costs historically incurred..." SBC Comments, p.89. Bell Atlantic asserts that "basing rates on incremental costs would deny LECs the ability to recoup any unrecovered historical investment." Bell Atlantic Comments, p. 36. BellSouth argues in its Comments that embedded costs "properly incurred pursuant to regulatory oversight" should be included in the measure of total costs that ILECs be permitted to recover in charges for interconnection and unbundled elements. BellSouth Comments, p. 57. Ameritech similarly argues that so-called "residual" costs, including costs associated with the "legacy of regulatory decisions" and with spare capacity, remain on the ILECs' books and cannot be ignored. According to Ameritech, these costs pertain to investments made to satisfy service obligations and which "encompass multiple generations of technology" such that "the resulting network will not be identical [i.e. will cost more relative] to the one that could be built today." Ameritech Comments, p. 68-70.

4. Affidavit of Jerry A. Hausman submitted with USTA Comments, para. 3.

5. *Id.*

Summary

On the basis of ETI's empirical analysis, we find that, as a general proposition, any "gap" between historical embedded costs and TSLRIC *cannot* be ascribed to either old/obsolete, or high cost plant, or to plant put in place to satisfy basic service demand as part of any explicit or implicit pre-competition regulatory condition imposed upon the ILECs.

In particular, what we see is that the majority of plant carried on the ILECs' books is relatively new, representing investments made by the ILECs during the 1990s – a time period in which fundamental regulatory changes, competitive inroads, and corresponding strategic responses, were clearly being contemplated and addressed by these companies. Moreover, of the plant acquired since January 1, 1990 that now constitutes the majority of most ILECs' net rate base, only a small fraction of the gross additions in digital switching and outside plant distribution facilities can be shown to have been required to support growth in basic service demand over this period. Furthermore, a large portion of the older (i.e., pre-1990) vintage plant remaining on the ILECs' books is associated with physical assets whose economic values may have actually appreciated, in that similar plant is still being acquired at reproduction costs (such as reflected in TSLRIC studies) that in many cases are likely to be *greater* than the original (historic) acquisition cost. Thus, rather than placing RBOCs at a competitive disadvantage relative to new entrants, the *composition* of the older plant remaining on the companies' books suggest that this older plant may actually represent "hidden" valuable assets for the ILECs

The overall approach employed in this Study has as its foundation the following three basic premises:

- First, the potential entry of competition in the local exchange market has not (or should not have) taken the ILECs by surprise, but rather has been (or certainly should have been) contemplated by the ILECs in ongoing investment and construction planning over the past several years. Accordingly, for purposes of evaluating ILEC claims of entitlement to recover revenues based upon historic embedded costs, it is appropriate to distinguish between "historic" embedded costs incurred by the ILECs in recent years from the historic embedded costs associated with the earlier pre-local exchange competition era;

- Second, the only embedded costs for which the ILECs should be even remotely justified in making a claim for any sort of entitlement to recovery are those associated with the provision of basic telephony services that relate to a specific regulatory mandate under the traditional rate-of-return regulatory regime. Embedded costs associated with strategic ILEC investments in modernized facilities designed either to provide new non-basic services (e.g., advanced or

broadband digital) or to acquire excess capacity over and above that explained by demand growth for basic service are not relevant in the context of carrier-to-carrier interconnection rates; and

- Third, embedded costs associated with certain types of plant (e.g., copper cable, buildings) may actually represent "hidden" assets for the ILECs to the extent that the current reproduction costs of such plant (as would be reflected in TSLRIC studies) exceed the historic costs carried on the ILECs' books. That the ILECs in the current market environment prefer to deploy fiber cable to replace copper distribution cable, and digital switches to replace analog switches (creating an excess of building space, among other things) is similarly not germane, since those deployment choices can, as a general proposition, be linked to strategic positioning on the part of the ILEC to provide *non*-basic --- and often *competitive* — services.

For these reasons, any attempt by ILECs to claim an entitlement to additional investment recovery over and beyond that supported by proper TSLRIC studies based upon the existence of a "gap" that can be attributed to newer, underutilized plant is not supportable on economic efficiency or public policy grounds. Indeed, the only purpose that would be served by granting ILECs additional revenue recovery based upon claims concerning any such "gap" would be to impose a significant competitive disadvantage upon new local exchange entrants.

To empirically test whether the conditions identified above regarding the vintage, composition, and utilization of plant are extant for the ILECs, several related empirical analyses were performed to examine trends in ILEC investment, depreciation, plant acquisition, retirement, and utilization, among other factors, for the period beginning January 1, 1990 to the present. As described in this Study, our empirical analyses demonstrate, with respect to the *vintage, composition, and utilization* of ILEC plant, that:

Vintage

- The overwhelming majority of ILEC plant is not particularly old or obsolete;
    - For the RBOCs, 60% of net Total Plant in Service (TPIS) as of the end of 1995 was acquired on or after January 1, 1990;
    - In the aggregate, newer vintage plant is replacing the older vintages at the steady pace of approximately 5%-10% per year (as a result of additions, retirements, and ongoing depreciation charges taken against existing plant), such that in the next several years, during the transition to a more competitive local exchange environment, the ILECs will have replaced or retired virtually

all categories of their pre-1990 embedded base of plant that has become economically and/or technologically obsolete;

- As early as the end of 1997, for example, for most RBOCs, only about 30% of net TPIS will be associated with older vintage plant.

Composition

- The composition of plant accounts — in terms of the proportion of surviving plant associated with older vs. newer vintages — varies with the type of plant and has significant implications with respect to the relative economic value of older versus newer vintage plant;

  - In particular, for plant accounts such as metallic (i.e., copper) cable, buildings, poles and conduit, for which current reproduction costs are higher than historic costs, there is a greater proportion (in the range of 70%) of pre-1990 vintage plant surviving in net TPIS;

  - In sharp contrast, for plant accounts such as non-metallic (i.e., fiber) cable, for which current costs are lower than historic, a markedly lower proportion of the plant (roughly half of that existing for metallic) is associated with older (i.e., pre-1990) vintages;

  - For a large portion of pre-1990 plant investment remaining on the RBOCs' books, historic embedded costs may be *lower* relative to current reproduction cost results.

Utilization

- ILEC additions to central office (CO) digital switching and outside plant facilities over the period January 1, 1990 through December 31, 1995 cannot be explained by basic service demand growth;

  - For the RBOCs, only between 12% to 37% of digital CO switching capacity that was added over the period January 1, 1990 through the end of 1995 can be characterized as demand driven, i.e., explained by growth in the demand for basic services;

- While there is a broader range of results across RBOCs, for some companies, the percentage of outside plant distribution facilities added between January 1, 1990 and the end of 1995 that can be explained by growth in demand for basic service ranges as low as –15.8% to 9%, where the "negative" utilization result indicates additional outside plant facilities were deployed despite experiencing an overall decline (i.e., negative growth) in basic service demand over the period;

- Even for companies at the "high" end, demand-driven outside plant utilization figures in the range of 66% to 82% suggest a substantial amount of historic investment that cannot be attributed to meeting basic service demand. For example, for BellSouth, an estimated loop plant utilization factor of 71% in conjunction with an estimated digital CO plant utilization factor of 34%, results in an estimated $2.9-billion in excess net plant relative to that required to satisfy growth in basic service demand over the 1990 to 1995 period;

- Of all the RBOCs, SBC Communications exhibits the highest (82%) outside plant utilization relative to that required to meet basic service demand growth, consistent with the generally unfavorable competitive climate for new entrants in its region, and its aggressive investments in cellular and other acquisitions. Conversely, companies exhibiting the lowest outside plant utilization, (Ameritech, NYNEX, and Bell Atlantic) operate in areas where regulatory and market conditions are relatively conducive to local competition;

- For RBOCs nationwide, we estimate in the order of magnitude of as much as $25-billion of historic net TPIS (as of the end of the 1995) that cannot be explained by basic service demand growth over the 1990 to 1995 period.

The time frame of the NPRM precludes the completion of a large number of data-intensive empirical analyses. However, this Study also examines several specific examples and other anecdotal evidence that further supports and expounds upon the conclusions of the quantitative empirical analyses. These include:

- ILEC involvement in the market for advanced Centrex-type services, which unlike POTS services, required the use of digital (as distinct from analog) central office switches, may have motivated the early replacement of analog central office switching plant, as well as the deployment of excess outside plant facilities;

- ILEC efforts to expand the market for additional residential lines and other discretionary services, required the ILEC to design and construct far more extensive feeder and distribution infrastructures (and expend far greater aggregate capital investments) than otherwise required to provision basic local exchange service, and appears to overwhelm simple growth in basic local exchange line demand as a principal capital investment driver; and

- ILEC strategic positioning in the market for advanced and broadband digital services has resulted in the ILECs significantly increasing feeder facilities relative to those actually required to meet demand for basic local exchange lines and other POTS services, and provides a far better explanation for capacity expansion than simple POTS demand growth.

2 STUDY APPROACH AND METHODOLOGY

General Study Approach

The overall approach utilized in this Study for purposes of evaluating ILEC claims of entitlement based upon historic embedded costs has as its foundation three basic premises:

(1) That the potential entry of competition in the local exchange market has not taken the ILECs by surprise, but rather has been (or certainly should have been) contemplated by the ILECs in ongoing investment and construction planning over these past several years;

(2) That the costs at issue are those incident to the provision of basic telephony services, and not those attributable to modernized facilities designed to support the offering of new non-basic and competitive services or to build in excess capacity over and above that required to serve basic service demand in anticipation of an expansion of business; and

(3) That embedded costs associated with certain types plant (e.g., copper cable, buildings) may actually represent "hidden" assets to the extent that the current reproduction costs of such plant (as would be reflected in TSLRIC studies) exceed the historic costs carried on the ILECs' books

On this basis, the general approach adopted in this Study is to examine trends in ILEC investment, depreciation, plant acquisition, retirement and utilization, among other factors, based upon a distinction between "historic" embedded costs incurred by the ILECs in more recent years from the historic embedded costs associated with the pre-local exchange competition era.

For purposes of this Study, we have selected January 1, 1990 as the cutover point between "historic" and "current" ILEC operating environments. While there cannot be a bright line separating these two "eras," January, 1990 is a reasonable break-point for several

reasons. During the period 1990 to the present (if not before), the ILECs have argued for price cap regulation for interstate services and in a majority of intrastate jurisdictions largely on the premise that they needed increased pricing flexibility and earnings growth in order to respond successfully to increasing competition in all aspects of their business. The ILECs have been successful in their efforts during this period to get out from under rate of return regulation with its emphasis on historical embedded costs and to enjoy the increased freedom under price cap regulation to make market-driven decisions.[6] During this period, local competition and related issues have been addressed extensively in the federal jurisdiction and in a large number of state jurisdictions.

To empirically test whether the conditions identified above regarding the vintage, composition, and utilization of plant are extant for the ILECs, several related empirical analyses were performed to examine trends in ILEC investment, depreciation, plant acquisition, retirement, and utilization, among other factors, for the period beginning January 1, 1990 to the present. We rely upon the latest data available from ARMIS, supplemented with data from various state commission and FCC decisions, depreciation studies, and monitoring reports, as supported by our general industry knowledge.

Vintage Analysis

The ultimate goal of the vintage analysis is to demonstrate how much of the net investment was acquired by the ILECs during the period beginning on and after January 1, 1990. Accordingly, we develop a methodology that allows for the attribution or breakdown of each of these categories as between the pre-January 1, 1990 and post-January 1, 1990 periods: In other words, for each year, starting in 1990, we distinguish how much of the TPIS can be characterized as pre-1990 vis-a-vis post-1990 plant.

The vintage analysis tracks several specific categories of data with respect to Total Plant In Service (TPIS) for each RBOC starting with the year 1990:

- Beginning TPIS balance;
- Annual changes (additions, retirements, other adjustments);
- Ending TPIS balance;
- Beginning accumulated depreciation, accruals, ending accumulated depreciation;

6. Over 70% of current ILEC revenue streams are regulated on the basis of "pure price caps" regulation. Merrill Lynch Report, "Telecom Services - Local," 23 April 1996.

- Composite depreciation rate; and
- Net TPIS.

The data used in the analysis was compiled or derived from various public sources: ARMIS Reports 4302 (Tables B1 and B5) were the source for all TPIS data including values for annual additions, retirements, other adjustments and accruals; various relevant state commissions and FCC decisions were the sources for depreciation rates; and generation arrangement tables provided by the ILECs to the FCC as part of their triennial depreciation filings were the source for survivorship percentages by plant vintage.

The methodology utilized in the vintage analysis can be summarized as follows: net pre-1990 TPIS consists of: all plant acquired before 1990, the portion of retirements related to pre-1990 plant vintages, depreciation accruals related to pre-1990 plant, other adjustments related to pre-1990 plant, and accumulated depreciation related to pre-1990 plant — derived on the basis of year-to-year tracking for each vintage plant. Correspondingly, net post-1990 TPIS consists of all plant acquired during and after 1990, offset by that portion of total retirements related to post-1990 plant vintages, depreciation accruals related to post-1990 plant, other adjustments related to post-1990 plant, and accumulated depreciation related to post-1990 plant. The pre-1990 TPIS amounts are typically derived as a residual, by subtracting the derived post-1990 amounts from the total TPIS amounts reported in ARMIS. Detailed spreadsheets following this methodology are presented in Appendix A to the Study.

The specific methodology used to assign categories to the pre- and post-1990 periods is described as follows:

Additions

The analysis assigns plant additions entirely to the post-1990 period, since assets added in each of the years beginning with 1990 through to the present are, by definition, post-1990 plant.

Retirements

Retirements apply to plant acquired before 1990 as well as to plant acquired after 1990, and accordingly, are attributed to both the pre-1990 and post-1990 periods. It is possible to estimate the portion of the total retirements charge attributable to each vintage of plant additions based upon generation arrangements data provided for each category of plant. In our analysis, retirements are attributed between the two periods based upon a weighted average survival curve derived from the survivorship data identified in the generation

arrangement tables described above. The weighted average curve considers the survival factors assigned to each plant account, properly weighted by each account's share of total investment. For simplification purposes, we selected seventeen TPIS categories of accounts to be included in our analysis.[7] These categories collectively account for over 90% of 1995 TPIS. The analysis resulted in a weighted average survival curve (yearly survival factors), which was then used to estimate the portion of retirements that relates to each vintage during the post-1990 period. For each year's retirement charge, we estimated the portion relating to the post-1990 period (using the survival curve to calculate each vintage's retirement expense) and subtracted that amount from the total retirement charge reported in ARMIS to derive the amount related to pre-1990 plant.

Accruals

The allocation of depreciation accruals to the pre- and post-1990 periods followed a similar method as that used for retirements. We derive a composite depreciation rate for each year in the post-1990 period using state- and FCC-prescribed rates. For example, for Pacific Bell, the California Public Utilities Commission (CPUC) allows depreciation rates to be adjusted on an annual basis, so the composite depreciation rates were generated for each year based upon annual CPUC-prescribed depreciation rates. In contrast, the Bell Atlantic companies only file depreciation rates on a triennial basis, with the state commissions generally adopting the depreciation rates approved by the FCC. For all companies, the composite rate was derived using a weighted average of the rates prescribed for each TPIS account, weighted according to the level of investment in each account. Composite depreciation rates were then estimated at the RBOC level for each year in the post-1990 period, by weighting the relevant state-level composite depreciation rates according to relative access line counts. For each RBOC, we utilized data that was readily available, and in all cases incorporated data for the largest state operations. The composite RBOC depreciation rate was then applied to the annual additions and to the net TPIS balance corresponding to the post-1990 period. The difference between the post-1990 accrual expense and the ARMIS reported depreciation expense determined the pre-1990 plant accrual expense. As with the retirement calculations, all balances were carried to the next year and considered in the following year's expense calculation.

7. These categories include Buildings, General Purpose Computers, Analog Electronic Switches, Digital Electronic Switches, Digital Electronic Switches, Digital Circuit, Analog Circuit, Poles, Aerial Cable Metallic Exchange, Aerial Cable Metallic Interoffice, Aerial Cable Non-metallic Exchange, Underground Cable Metallic Exchange, Underground Cable Metallic Interoffice, Underground Cable Non-metallic Interoffice, Buried Cable Metallic Exchange, Buried Cable Metallic Interoffice, and Buried Cable Non-metallic Interoffice, and Conduit.

Other Adjustments

The category "Other Adjustments" in the Depreciation section (ARMIS Form 43-02, Table B-5) includes Salvage, Other Credits, Cost of Removal, Other Charges and any discrepancy in Retirements. These amounts generally related to retirements and accordingly were allocated as between pre-1990 and post-1990 periods in proportion to retirements. Similarly, where there existed non-zero entries in the "Transfers/Adjustments" column in the calculation of the ending TPIS balance (ARMIS Form 43-02 Table B-1), that amount was also allocated in proportion to retirements.

The vintage analysis worksheets are reproduced in Appendix A to this Study.

Composition Analysis

While the vintage analysis described above examines ILEC embedded investment at the aggregate TPIS level, the composition analysis uses the *plant-specific data* provided in the generation arrangement tables (submitted by the ILECs to the FCC as part of their depreciation filings[8]) in order to answer the question of how the composition of plant accounts — in terms of the proportion of surviving plant associated with older vs. newer vintages — varies with the type of plant, and to examine the implications of any observed variation in terms of its impact upon the "gap" between historic embedded costs and TSLRIC results.

To the extent it can be shown that for copper plant accounts there is a greater proportion of older vintage plant surviving vis-a-vis the results for net TPIS, this effectively rebuts the notion that older vintage ILEC plant is comprised of more costly plant relative to that which would be costed out under TSLRIC. As another example, building space freed up by the lower space requirements of digital switching equipment vis-a-vis the analog equipment it replaces has significant revenue generating potential for the ILECs, particularly in the context of the demand for collocation. Thus, similar to the case of copper plant, building plant accounts would provide another prime example of valuable older vintage assets.

For this study, we have examined generation arrangement data for the principal plant accounts for one representative state operating area (the largest based upon number of access lines) per RBOC. Based upon our examination of the generation arrangement data,

8. As noted above, the data provided in the generation arrangements information was also used in the vintage analysis as the source of plant survivorship curves from which pre- and post- 1990 retirements were estimated.

we observe a consistent trend across ILECs with respect to survivorship percentages for various plant categories.

The composition analysis is performed directly from the information provided by ILEC generation arrangement tables. The generation arrangement table identifies for each plant account the proportion of plant surviving for each year, as well as the total amount surviving for that particular plant account. In general terms, we estimate the amount of post-1990 plant surviving on the ILEC's books by simply adding together the respective amounts of surviving plant identified in the generation arrangement table for each of the years 1990 through 1995. An estimate of the pre-1990 plant is derived by subtracting the post-1990 estimate from the total amount surviving. The analysis is performed on plant account categories that together comprise generally over 90% of RBOC TPIS.[9]

Before doing these calculations, however, two intermediate steps are required. In order to minimize data requirements, we first combine the various disaggregated plant account categories into a single composite category. For example, the various cable (e.g., aerial, buried, and underground) accounts are combined into a composite cable category. Second, for most companies, the latest data available is for the year 1994. To estimate the post-1990 surviving plant through the end of 1995, consistent with the study period covered by our analysis, we estimate surviving amounts for 1995 (and in the case of Pacific Bell for 1994 as well) by applying the average annual growth rate for the most recent three year period.

The composition analysis worksheets are reproduced in Appendix B to this Study.

Utilization Analysis

The purpose of the utilization analysis is to further examine the post-1990 investment in order to determine what portion of aggregate RBOC investment could actually be attributed to meeting growth in demand for basic service. To the extent that a large portion of investments in central office and/or outside plant can be shown to be underutilized relative to that required to meet POTS (for Plain Old Telephone Service) access line growth demand, it would suggest that such investments may have been motivated by strategic considerations rather than growth-driven requirements associated with the provision of basic services (and hence not appropriately recovered in the rates for carrier-to-carrier interconnection and unbundled elements).

9. These categories are the same ones used in the development of survival curves in the vintage analysis and are identified in footnote 7, *supra*.

The utilization analysis is developed based upon a combination of data from ARMIS and from deployment and utilization forecasts submitted to the FCC and to state PUCs. The analysis consists of three basic steps:

- First, we derive estimates of the percentage of digital CO and loop plant additions, respectively, that can be explained by basic demand growth;

- Second, the "utilization" percentages estimated in the preceding step are applied to annual plant additions (and corresponding retirements) for the post-1990 period to derive an estimate of the amount of plant additions in the 1990 to 1995 period that are "demand-driven," i.e., that can be explained by demand growth for basic service; and

- Third, those revised plant additions and retirements are run through the vintage model to produce a revised net TPIS result as of the end of 1995, the objective of which is to more closely track what ILEC net TPIS would have been had ILEC plant acquisition been driven solely by basic service demand growth.

Determination of utilization levels for digital CO and loop plant

We first determine the percentage of digital CO capacity and loop plant that can be explained by demand growth for basic service. Data available from ARMIS Form 43-07 on "Total Number of Access Lines in Service"[10], adjusted to remove all but the PBX trunk-equivalent measure of non-basic Centrex lines,[11] is used as the measure of basic demand growth relating to digital CO capacity. "Total Working Channels" data, similarly adjusted to remove non-basic Centrex lines, is used as the measure of basic demand growth relating

10. As described in ARMIS Report Definitions, Row 120 - *Total Number of Access Lines In Service* - is equal to the sum of rows 140 *E/M Lines Served* (the number of lines served by Electro-Mechanical switches), 160 *ASPC Lines Served* (the number of lines served by Analog Stored Program Controlled switches), and 180 *DSPC Lines Served* (the number of lines served by Digital Stored Program Controlled switches), rounded to the nearest thousand. Total Access lines in Service include all classifications of local telephone service including, but not limited to, individual lines, party line access, PBX access, Centrex access, Coin access, Foreign Exchange access and WATS access. FCC ARMIS Infrastructure Report 43-07 Report Definitions, Row Instructions, August 1993.

11. Data on Centrex extensions was taken from ARMIS Report 4308 (Operating Data) for the years 1991-1994. Data on Centrex lines for 1990 was not available, so we applied the average growth rate for the period 1991-1994 to the 1991 amount to derive an estimate of the 1990 value. An average trunk equivalency ratio of 8:1 was applied to the number of Centrex extensions to arrive at the PBX equivalent number of Centrex lines.